neglected. Ruschak applied the approximation to the final stage and then suddenly changed the rules and included h_x^2 in the curvature term K. If terms of the order $0(h_x^2)$ were important then for example, the boundary condition $u_y = 0$ should have been $u_y(1 - h_x^2) + u_x = 0$, instead and this would have contributed to a considerable change in the results.

M. N. ESMAIL
Department of Chemistry
and Chemical Engineering
University of Saskatchewan
Saskatoon, Saskatchewan S7N 0W0
Canada

Reply:

The criticisms by Esmail of the paper "Flow of a Falling Film into a Pool" are rejected. Esmail does not contest the main result of the paper, which is a mechanism for the rapid thinning of a liquid film where it enters a pool. The insight is useful, as the phenomenon occurs in many flows. Recently, Jones and Wilson [*J. Fluid Mech.*, **87**, 263 (1978)] found the phenomenon to be important in bubble coalescence and arrived at the same mechanism.

Contrary to Esmail's claim, the two dimensionless groups employed in the paper, namely the Reynolds number, R, and the ratio of the film thickness far upstream to the capillary length, d, are independent. The flow has five independent parameters (ρ, μ, σ, G, and D) from which two independent dimensionless groups can be formed. Given only R, d cannot be calculated. Indeed this is obvious, as d involves surface tension whereas R does not.

The exact solution given to the approximate governing equation at zero Reynolds number is applicable on an interval of Reynolds number about zero. The region of applicability was determined by finding the first effects of increasing Reynolds number. It is difficult to see what confuses Esmail about this standard approach.

The concept of a pool of liquid, as used in the paper, implies that the region into which the film flows, whether bounded or unbounded in extent, may be regarded as motionless. It certainly does not imply that the interface is ultimately horizontal. If the film thickness far upstream is much less than the characteristic dimension of the region into which the film flows, then that region is, relative to the film, a pool. Flow at the rear of a long bubble rising through a slot is one example where the interface is not ultimately horizontal.

Esmail is stating the obvious when he points out that the paper is not about the ripples above a stationary surface film which is parallel to the wall or about those produced by a fine needle. As even the title of the paper makes plain, the analysis applies where a liquid layer flows into a relatively large reservoir. Regardless of whether a stationary surface film is present, the pressure in the liquid drops from atmospheric where the flow parallels the wall to below atmospheric in the reservoir near the wall where the meniscus is curved. The viscous dissipation of this pressure drop gives rise to film thinning and ripples above the reservoir, as explained in the paper.

The mathematical analysis employed is consistent provided that it is verified a posteriori that dynamic effects in the liquid layer become negligible while the slope of the interface is still small. This was the case for the results presented.

KENNETH J. RUSCHAK
Eastman Kodak Company
Research Laboratories
1669 Lake Avenue
Rochester, NY 14650

To the Editor:

We believe that the following corrections are necessary in the paper of Bhavaraju et al. (1978).

In Part I (p. 1063),

1) Equation (25) should read

$$\gamma_0 = \sigma^2(1 + H)$$

2) Equation (47) should read

$$\tilde{\tau}_{rr}|_{\tilde{r}=R} = \sigma^{2m}\,[2\cos\theta + m(-7.6\cos\theta + 9.1\cos^3\theta - 3.1\cos^5\theta + 1.5\cos^7\theta)]$$

3) In Equation (51), the exponent of 2 should be $2m$ rather than m.

4) In Fig. 2, the scale of the ordinate goes from 1.0 to 2.0.

In Part II (p. 1070), by examining the dissertation of Bhavaraju (1978), the following corrections appear to be necessary in order that Equations (13) thru (16) would yield results that agree with those in Fig. 2.

1) In Equations (13) and (14) the denominators should read $1 - \phi^{-(2n+3)/3}$ rather than $1 - \phi - (2n+3)/3$.

2) In Equation (15), the first term on the right hand side should read

$$\frac{6n(n-1)}{(2n+1)(1-\phi^{1/3})}$$

rather than

$$\frac{6n(n-1)}{(2n+1)(1-\phi^{1/3})^2}$$

VASANTI DESHPANDE
AND L. E. ERICKSON
Department of Chemical Engineering
Kansas State University
Manhattan, Kansas 66506

LITERATURE CITED

Bhavaraju, S. M., "Mass transfer in simple and viscous gas-liquid contactors for fermentation processes," Ph.D. dissertation, Univ. Microfilms Internatl., Ann Arbor, Michigan (1978).

Bhavaraju, S. M., R. A. Mashelkar, and H. W. Blanch, "Bubble Motion and Mass Transfer in non-Newtonian Fluids," *AIChE J.*, **24**, 1063 and 1070 (1978).

ERRATA

In the Letters to the Editor section [*AIChE J.*, **26**, 334 (1980)] the address for R. G. Rice should read: Chemical Engineering Department, Montana State University, Bozeman, Montana 59717.

In "Bubble Motion and Mass Transfer in Non-Newtonian Fluids," by Bhavaraju, S. M., Mashelkar, R. A., and Blanch, H. W., *AIChE J.* **24** Part I, 1063, Part II, 1070, the following should read:

Part I

Equation (25)

$$\gamma_0 = \dot{\sigma}^2(1 + H)$$

Equation (47)

$$\tilde{\tau}rr|_{\tilde{r}=R} = \sigma^{2m}[2\cos\theta + m(-7.6\cos\theta + 9.1\cos^3\theta - 3.1\cos^5\theta + 1.5\cos^7\theta]$$

Equation (51)

$$F^D(m) = 3^m 2^{2m}\,(1 - 7.66\text{m})$$

Part II

Equation (13), (14)—denominators should read $[1 - [\phi^{-2n+3)/3}]$

Equation (15) right hand side should read

$$\frac{6n(n-1)}{(2n+1)(1-\phi^{1/3})}$$

In "Restrictions and Equivalence of Optimal Temperature Policies for Reactors with Decaying Catalysts" by J. M. Pommersheim, L. L. Tavlarides and S. Mukkavilli [*AIChE, J.*, **26**, 327 (1980)] a number of corrections of typographical errors which were made by the authors in the galleys were not executed prior to printing. The corrections follow:

p 327, column 2, line 1; "to the" should read "to be".

p 327, column 2, line 3; "Equation" should read "Equations".

Equation (6); "dg_k" should read "dy_k".

p 328, column 1, line 1; "$\partial\psi$" should read "$d\psi$".

p 328, column 1, line 22; "$E_D > E_R$" should read "$E_D < E_R$".

Equation (11); "E_r" should read "E_R".

Equation (26); "$\left(\frac{\partial F}{\partial \dot{y}_{k-}}\right) = \left(\frac{\partial F}{\partial \dot{y}_{k+}}\right)$" should read "$\left(\frac{\partial F}{\partial \dot{y}_k}\right)_- = \left(\frac{\partial F}{\partial \dot{y}_k}\right)_+$".

p 329, column 2, line 42; "Litmann" should read "Leitmann".

p 330, column 1, line 8; "rate constant for deactivation reaction" should read "frequency factor for reaction."

p 330, column 1, line 15; "∂_y" should read "∂y".